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# Foundations of Software Science and Computational Structures

13th International Conference, FOSSACS 2010  
Held as Part of the Joint European Conferences  
on Theory and Practice of Software, ETAPS 2010  
Paphos, Cyprus, March 20-28, 2010. Proceedings

Volume Editor

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# Foreword

ETAPS 2010 was the 13th instance of the European Joint Conferences on Theory and Practice of Software. ETAPS is an annual federated conference that was established in 1998 by combining a number of existing and new conferences. This year it comprised the usual five sister conferences (CC, ESOP, FASE, FOSSACS, TACAS), 19 satellite workshops (ACCAT, ARSPA-WITS, Bytecode, CMCS, COCV, DCC, DICE, FBTC, FESCA, FOSS-AMA, GaLoP, GT-VMT, LDTA, MBT, PLACES, QAPL, SafeCert, WGT, and WRLA) and seven invited lectures (excluding those that were specific to the satellite events). The five main conferences this year received 497 submissions (including 31 tool demonstration papers), 130 of which were accepted (10 tool demos), giving an overall acceptance rate of 26%, with most of the conferences at around 24%. Congratulations therefore to all the authors who made it to the final programme! I hope that most of the other authors will still have found a way of participating in this exciting event, and that you will all continue submitting to ETAPS and contributing to make of it the best conference on software science and engineering.

The events that comprise ETAPS address various aspects of the system development process, including specification, design, implementation, analysis and improvement. The languages, methodologies and tools which support these activities are all well within its scope. Different blends of theory and practice are represented, with an inclination toward theory with a practical motivation on the one hand and soundly based practice on the other. Many of the issues involved in software design apply to systems in general, including hardware systems, and the emphasis on software is not intended to be exclusive.

ETAPS is a confederation in which each event retains its own identity, with a separate Programme Committee and proceedings. Its format is open-ended, allowing it to grow and evolve as time goes by. Contributed talks and system demonstrations are in synchronised parallel sessions, with invited lectures in plenary sessions. Two of the invited lectures are reserved for ‘unifying’ talks on topics of interest to the whole range of ETAPS attendees. The aim of cramming all this activity into a single one-week meeting is to create a strong magnet for academic and industrial researchers working on topics within its scope, giving them the opportunity to learn about research in related areas, and thereby to foster new and existing links between work in areas that were formerly addressed in separate meetings.

ETAPS 2010 was organised by the University of Cyprus in cooperation with:

- ▷ European Association for Theoretical Computer Science (EATCS)
- ▷ European Association for Programming Languages and Systems (EAPLS)
- ▷ European Association of Software Science and Technology (EASST)

and with support from the Cyprus Tourism Organisation.

The organising team comprised:

General Chairs: Tiziana Margaria and Anna Philippou  
 Local Chair: George Papadopoulos  
 Secretariat: Maria Kittira  
 Administration: Petros Stratis  
 Satellite Events: Anna Philippou  
 Website: Konstantinos Kakousis.

Overall planning for ETAPS conferences is the responsibility of its Steering Committee, whose current membership is:

Vladimiro Sassone (Southampton, Chair), Parosh Abdulla (Uppsala), Luca de Alfaro (Santa Cruz), Gilles Barthe (IMDEA-Software), Giuseppe Castagna (CNRS Paris), Marsha Chechik (Toronto), Sophia Drossopoulou (Imperial College London), Javier Esparza (TU Munich), Dimitra Giannakopoulou (CMU/NASA Ames), Andrew D. Gordon (MSR Cambridge), Rajiv Gupta (UC Riverside), Chris Hankin (Imperial College London), Holger Hermanns (Saarbrücken), Mike Hinchey (Lero, the Irish Software Engineering Research Centre), Martin Hofmann (LM Munich), Joost-Pieter Katoen (Aachen), Paul Klint (Amsterdam), Jens Knoop (Vienna), Shriram Krishnamurthi (Brown), Kim Larsen (Aalborg), Rustan Leino (MSR Redmond), Gerald Luetzgen (Bamberg), Rupak Majumdar (Los Angeles), Tiziana Margaria (Potsdam), Ugo Montanari (Pisa), Oege de Moor (Oxford), Luke Ong (Oxford), Fernando Orejas (Barcelona), Catuscia Palamidessi (INRIA Paris), George Papadopoulos (Cyprus), David Rosenblum (UCL), Don Sannella (Edinburgh), João Saraiva (Minho), Michael Schwartzbach (Aarhus), Perdita Stevens (Edinburgh), Gabriele Taentzer (Marburg), and Martin Wirsing (LM Munich).

I would like to express my sincere gratitude to all of these people and organisations, the Programme Committee Chairs and members of the ETAPS conferences, the organisers of the satellite events, the speakers themselves, the many reviewers, all the participants, and Springer for agreeing to publish the ETAPS proceedings in the ARCoSS subline.

Finally, I would like to thank the organising Chair of ETAPS 2010, George Papadopoulos, for arranging for us to have ETAPS in the most beautiful surroundings of Paphos.

# Preface

This volume contains the proceedings of the 13th International Conference on the Foundations of Software Science and Computational Structures (FoSSaCS) 2010, held in Paphos, Cyprus, 20–28 March 2010. FoSSaCS is an event of the Joint European Conferences on Theory and Practice of Software (ETAPS). The previous 12 FoSSaCS conferences took place in Lisbon (1998), Amsterdam (1999), Berlin (2000), Genoa (2001), Grenoble (2002), Warsaw (2003), Barcelona (2004), Edinburgh (2005), Vienna (2006), Braga (2007), Budapest (2008) and York (2009).

FoSSaCS presents original papers on the foundations of software science. The Programme Committee (PC) invited submissions on theories and methods to support analysis, synthesis, transformation and verification of programs and software systems.

We received 110 abstracts and 86 full paper submissions; of these, 25 were selected for presentation at FoSSaCS and inclusion in the proceedings. Also included is the abstract of a lecture, “Introduction to Decidability of Higher-Order Matching” by Colin Stirling, the FoSSaCS 2010 invited speaker. The PC members, and the external experts they consulted, wrote a total of over 460 paper reviews, and the discussion phase of the meeting involved several hundred messages. The competition was extremely keen; unfortunately many good papers could not be accepted.

I thank all the authors of papers submitted to FoSSaCS 2010. I thank also members of the PC for their sterling work, as well as the external reviewers for the expert help and reviews they provided. Throughout the phases of submission, evaluation, and production of the proceedings, we relied on the invaluable assistance of the EasyChair system; we are very grateful to its developer Andrei Voronkov and his team. Last but not least, we would like to thank the ETAPS 2010 Local Organizing Committee (chaired by George A. Papadopoulos) and the ETAPS Steering Committee (chaired by Vladimiro Sassone) for their efficient coordination of all the activities leading up to FoSSaCS 2010.

January 2010

Luke Ong

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